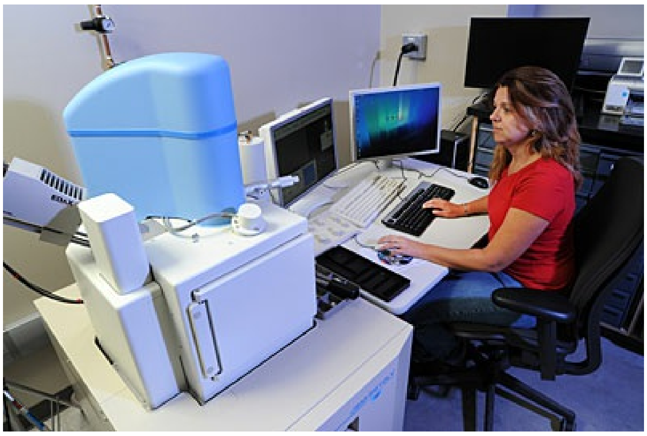


The Microscopy and Characterization Suite in the Center for Advanced Energy Studies at INL has seen booming demand—with twice as many hours booked in June compared to last year and an average of 15 hours of use per day.

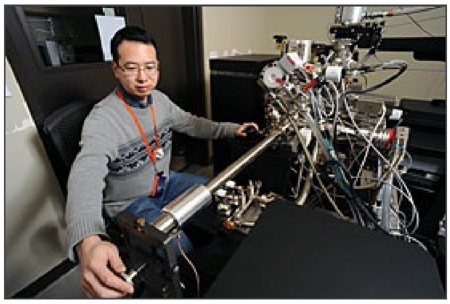
## World-class laboratory in Idaho brings in researchers from far and wide

By Alexandra Branscombe *for INL Communications & Governmental Affairs*

A relatively new facility in Idaho Falls has become one of the most popular, and people are all but lining up at the door to get in.

Two years after the Microscopy and Characterization Suite (MaCS) opened in the Center for Advanced Energy Studies, the laboratory is booked solid through September.

The reason MaCS is so popular is the relatively easy access to research tools that help answer some of today's most critical questions in nuclear materials science. The suite boasts a collection of high-end equipment that has scientists from academia and private industry waiting for availabilities.



***Yaqiao Wu, a Boise State instrument lead, uses the Local Electrode Atom Probe to create a high resolution 3-D view of a material sample.***

"Researchers are flocking in," said Darryl Butt, a Boise State University researcher and a CAES associate director. "The expertise that we have at MaCS is fantastic; the reason customers keep coming back is because they get an incredible product."

During MaCS's first year of operation, few researchers outside the CAES partnership — Idaho National Laboratory, Boise State University, Idaho State University and the University of Idaho — used the facility, or knew it existed. But steadily, more research institutions discovered the lab, and are now waiting for openings with the leading instruments.

In June 2012, researchers had reserved about 350 hours to work with the suite equipment. This summer, the MaCS suite logged more than 700 hours of use in June, and is currently booked for an average of 15 hours every day.

Users include research scientists from more than 10 universities in six states and one foreign country—some are first-timers and others are returning customers. Researchers from private industry, including Micron and Atomic Energy of Canada Limited, also are regular MaCS users.

**Stepping in**

Because MaCS resides within CAES – a state of Idaho building –it can easily be accessed by private industry, government agencies and universities outside of the partnership.

***Jatu Burns works on the Focused Ion Beam (FIB) to cut nano-scale material samples for researchers.***

MaCS also was made possible largely through a partnership with the Advanced Test Reactor National Scientific User Facility (ATR NSUF), which is based at INL. ATR NSUF competitively awards external researchers access to unique experiment irradiation and post-irradiation examination capabilities located at INL, CAES, and a diverse mix of affiliated partner institutions at universities, national laboratories and industry facilities located across the country.

"The nature of multi-institutional space brings people together to talk and collaborate," said Butt. "This directly benefits society, creating a space that physically brings people together and promotes interactions that wouldn't otherwise happen."

The cutting-edge nature of the equipment in MaCS also contributes to the high demand. In addition to being open to external researchers, the suite supports advanced microscopy for both radiological and nonradiological materials. The most sought-after equipment includes:

• The Focused Ion Beam (FIB): a focused beam of ions used to cut materials at the micro- and nanoscale. FIB can cut a sample smaller than 10 microns (the width of human hair is around 100 microns). This tool enables handling control and precise cutting of material, which is a huge benefit

to scientists.
• The Transmission Electron Microscope (TEM): an electron microscope that can magnify up to 300 million times more than a glass-lens microscope. Researchers can study how radiation damage affects structure and chemistry in a material sample using this instrument at nanometer to atomic level.
• The Local Electrode Atom Probe (LEAP): a state-of-the-art instrument that analyzes materials in a real 3-D space at the atomic level. At this high resolution, researchers can study spatial relationships and chemical distributions of individual atoms during or after radiation.

And while the equipment draws customers, the real power behind MaCS's instruments is the highly trained technical staff: Jatu Burns and Yaqiao Wu, both instrument leads from Boise State University.

"We wouldn't be able to run MaCS without them," said Joanna Taylor, the MaCS Laboratory lead for CAES. "It takes very specialized people to provide the level of support, training and analysis that they do."

***Wu and ATR NSUF chief scientist James Cole look at material structure and chemistry through the Transmission Electron Microscope (TEM).***

Burns and Wu run tests for customers and operate the high-performance tools. They also provide training so researchers can use the instruments and access MaCS on their own.

"Let's say you show up to CAES today and want to run an experiment," said Taylor. "The way we are set up—we could have the lab orientation, training and access granted all in a day—you could be working in the laboratory in the same day."

**Answering nuclear questions**

One example of how MaCS is advancing nuclear research and safety can be found within a project through the ATR NSUF, explained James Cole, chief scientist for ATR NSUF and INL technical interface with MaCS. The tools in MaCS aid research of radiation-induced brittle phases of steel materials. Studying steel damage on the atomic level helps scientists understand how materials age in reactors.

"We can input the information we get from MaCS into models to predict material performance outcomes," said Cole, explaining that models can help nuclear scientists and engineers create strategies to enhance safety in nuclear reactors.

Having more than $6.5 million in state-of-the-art instruments, backed by highly specialized instrument leads, MaCS has already established itself as a leading laboratory for energy and materials research. Its success demonstrates the benefits of collaboration and cross-institutional partnership for the global research community.

"MaCS was built to fill the need for a facility to work with nuclear materials; inside the laboratory are an array of tools you won't find a collection of anywhere in the world," said Butt. "The facility provides world-class instruments to universities and to industry."

*(Posted Sept. 20, 2013)*

Feature Archive